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(54) **Device for drawing off sheets from a sheet stack**

(57) Sheets are separated from a stack by two parallel take-off rolls (17, 19) one above the other, the sheet stack (11) being urged resiliently upwardly against the lower take-off roll (19). The lower take-off roll (19) is freely rotatably mounted on a pivotable control rail (23) and urged by spring (27) against the driven, upper take-off roll (17). As long as no sheet (13) is introduced between the take-off rolls (17, 19), the lower take-off roll (19) separates sheets from the stack (11) and transfers them to between the take-off rolls (17, 19), but when the uppermost sheet (13) is introduced between the take off rolls (17, 19) the control means moves the lower take-off roll (19) away from the upper take-off roll (17). The take-off device is capable of withdrawing from the sheet stack even sheets sticking to one another or stapled to one another. The control means may comprise dogs (47) on rail (23) engaging in circumferential grooves in the upper take-off roll (17).

FIG. 1

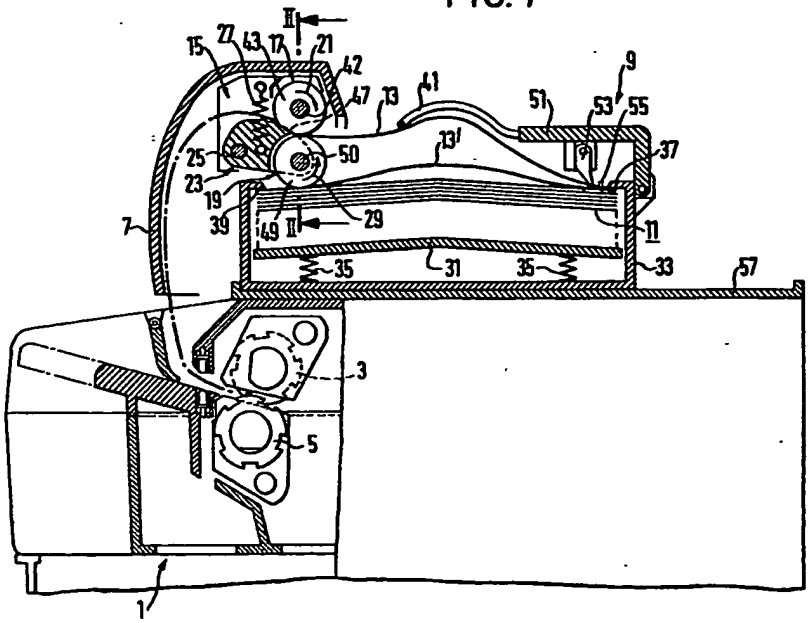

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FIG. 1

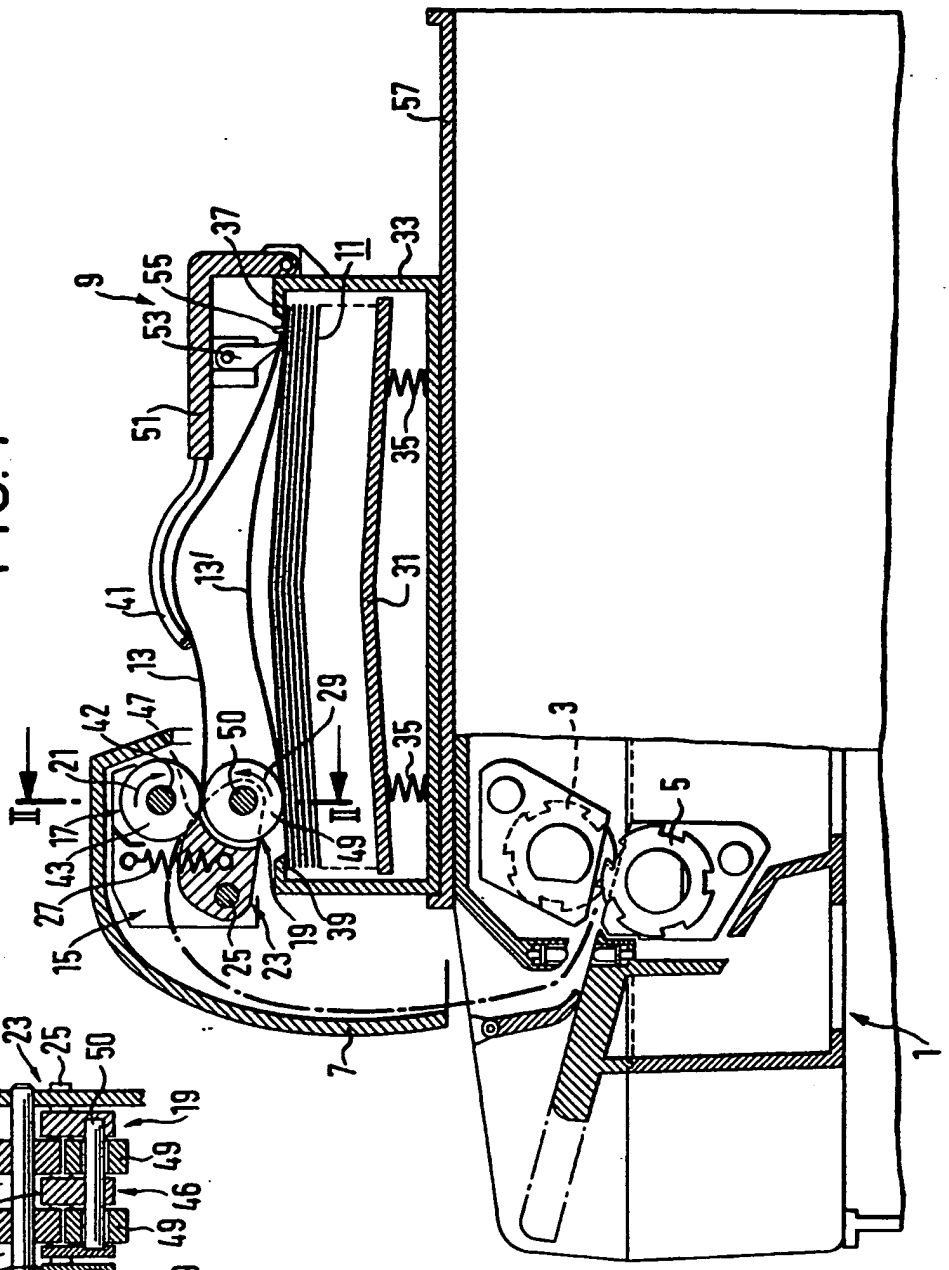
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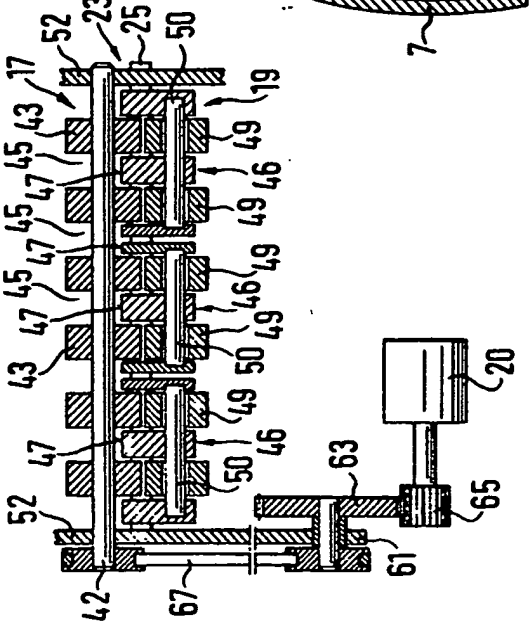
FIG. 2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SPECIFICATION

Device for drawing off sheets from a sheet stack

The invention relates to a device for drawing off sheets from a sheet stack, having a carrier floor for supporting the sheet stack, a take-off roll mechanism which comprises at least one take-off roll arranged above the carrier floor and driven by a motor about an axis of rotation parallel to the carrier floor and a feed device for the sheet stack which resiliently moves the carrier floor and the take-off roll mechanism towards one another.

In known sheet intake devices of this kind the motor-driven take-off roll engages in frictional engagement with the uppermost sheet of the sheet stack and displaces the sheet along the sheet stack. The friction force displacing the uppermost sheet is determined by the pressure application force with which the take-off roll and the sheet stack are pressed against one another. The sheet stack here forms the counter-pressure face for the uppermost sheet in each case to be withdrawn. Since the take-off forces achievable with such a take-off device are relatively small, faults can occur in the singling of sheet stacks with sheets adhering for example electrostatically to one another. The known take-off device more especially cannot be used as sheet-intake apparatus for willowing machines in which the sheets are to be fed singly from sheet stacks connected by metal clips, or the sheets of the sheet stack are crinkled or torn.

It is the problem of the invention to show a constructively simple way in which the take-off force of a device for drawing sheets off from a sheet stack can be increased. More especially the object is to be achieved that even sheets adhering to one another can be withdrawn singly from the sheet stack.

On the basis of the device as already explained this problem is solved in accordance with the invention in that between the motor-driven first take-off roll of the take-off roll mechanism and the carrier floor there is arranged a freely rotatable second take-off roll guided parallel with the axis of the first take-off roll and transversely of the axis of rotation, which second take-off roll in a first position is driven by the first take-off roll for the take-off of sheets of the sheet stack in frictional engagement and in a second position is lifted away from the first take-off roll, in that seen in the sheet withdrawal direction of the second take-off roll, at a distance therefrom an abutment is provided at least for the uppermost sheet in each case of the sheet stack, in that to the first take-off roll there is allocated a counter-pressure device for the transport of sheets introduced between the two take-off rolls and in that to the second take-off roll there is allocated a control device responding to sheets introduced between the two take-off rolls, which moves the second take-off roll into the first position in the absence of sheets and into the second position when sheets are present.

In this device the uppermost sheet of the sheet stack is moved by the second take-off roll over a comparatively short distance contrarily of the take-off direction of the first take-off roll and is curved upwards after the uppermost sheet abuts on the abutment with its edge remote from the take-off roll. The uppermost sheet is partially lifted and introduced between the two take-off rolls. The first take-off roll grasps the uppermost sheet between itself and the counter-pressure device separately allocated to it, whereby substantially higher friction and take-off forces can be achieved. The second take-off roll is driven intermittently in frictional engagement by the first take-off roll, while a control device lifts the second take-off roll from the first and thus halts it when the uppermost sheet has entered the take-off path between the first take-off roll and preferably the counter-pressure device. In this way the object is achieved that the sheets are drawn off individually one after the other.

When sheets are to be introduced between the two take-off rolls it must be ensured that the second take-off roll is lifted for halting away from the first take-off roll by more than the sheet thickness. This can take place in various manners. Thus the control device controlling the intermittent operation of the second take-off roll can be an electrical device which by means of an electric sensor, for example a sensor switch or a light barrier, detects the entry of a sheet into the take-off path and lifts the second take-off roll from the first for example electromagnetically. A comparatively simple, purely mechanical construction for the intermittent controlling of the second take-off roll consists in that the second take-off roll is freely rotatably mounted on a control rail which is pivotable axially parallel with the axis of rotation of the first take-off roll and initially stressed resiliently towards the first take-off roll, in that the first take-off roll comprises circumferential grooves and in that the control rail comprises control dogs which, at least in the first position of the second take-off roll, engage in the circumferential grooves. The sheet entering the take-off path forces the control dogs at least partially, but by more than the sheet thickness, out of the circumferential grooves, whereby the second take-off roll is lifted away from the first take-off roll by more than the sheet thickness and is halted.

The mechanical control arrangement as explained above can lead to a stressing of the sheets to be withdrawn which is undesired for many areas of use. Protective drawing off of the sheets from the sheet stack with adequate lifting away of the second take-off roll can be achieved if the second take-off roll is freely rotatably mounted on a control rail which is pivotable axially parallel with the rotation axis of the first take-off roll and initially stressed resiliently towards the first take-off roll and the control rail carries control faces cooperating with the first take-off roll for the control movement of the second take-off roll, the distance of which faces from the pivot axis of the control rail is less than the distance of the axis of rotation of the second take-off roll from the pivot axis. The control rail here forms a lever linkage by which the second take-off roll is lifted by means of the control faces by more than the sheet thickness. The control faces can at the same time form the counter-pressure faces of the first take-off roll and are preferably formed as counter-pressure rolls mounted freely rotatably on the control rail.

In a preferred form of embodiment the control rail

consists of a plurality of mutually relatively movable segments arranged side-by-side in the axial diretion and carrying the control faces or control dogs. The second take-off roll here consists of a plurality of take-off rolls mounted axially parallel on the segments, the movement of which is controlled by the control faces of the segments on which they are mounted. This measure improves the operational reliability of the take-off device. More especially even creased or folded sheets or torn or marginally damaged sheets can be drawn off satisfactorily. The sheet to be lifted from the second take-off roll is transmitted out beneath the second take-off roll even if for example by reason of the crease or tear parts of this sheet are already grasped by the first take-off roll.

The control rail expediently at the same time forms counter-pressure faces which are initially stressed resiliently towards the first presser roll. The counter-pressure faces can be circumferential faces of additional rolls or cylinders mounted axially parallel and freely rotatably on the control rail. To simplify the construction however it is preferredly provided that the counter-pressure faces are formed by prolongations of the control dogs engaging in the circumferential grooves of the first take-off roll, so that a direct abutting contact between the counter-pressure faces and the first presser roll is avoided. Since admittedly in this version the sheet to be withdrawn is conducted in serpentine form through the circumferential grooves, this version is to be used primarily in applications, as for example willowing machine applications, where protective treatment of the sheets is not important.

The take-off roll mechanism and the carrier floor are initially stressed resiliently towards one another and guided movably in relation to one another for the feed of the sheet stack. In a preferred form of embodiment the take-off roll mechanism is held fast with the machine while the carrier floor is guided substantially vertically displaceably in a frame and initially stressed by means of at least one spring upwards towards the second take-off roll. This configuration permits the arrangement of the abutment and of a stop limiting the upward curvature of the sheets fast with the frame above the carrier floor between the first take-off roll and the abutment. By means of such a stop it is possible to ensure in a constructionally simple manner that the uppermost sheet in each case, by reason of its stress caused by the upward curvature reliably spreads out to between the two take-off rolls as soon as it is pushed out beneath the second take-off roll. The stop can be pivotably fitted on the frame in order to facilitate the charging of the carrier floor from above.

The sheet intake device according to the invention as a rule detaches sheets sticking to one another already by the fact that the second take-off roll upwardly curves the uppermost sheet and thus lifts it from the sheet stack before the first take-off roll grasps and withdraws the uppermost sheet. Especially in willowing machine applications, staples or the like which clip the sheets stacked together at the end remote from the take-off rolls can prevent the withdrawal of the uppermost sheet. In order that the uppermost sheet may be torn out of the staple, preferably at least one tearing tooth penetrating into the sheet stack is provided on the frame in the region of the abutment. The tearing tooth penetrates the uppermost sheet and engages with its sharp point in the sheet lying therebeneath. In the withdrawal of the uppermost sheet the tearing tooth tears into the uppermost sheet, while it holds the sheet lying therebeneath, including the staple, fast.

In order that the frame may be charged in a simple manner with the sheet stack, it is expediently formed as a container displaceable in relation to the take-off roll mechanism, from which stop projections protrude towards one another above the carrier floor in the region of the take-off roll mechanism and the side opposite to the take-off roll mechanism. In this way the sheet stack can be laid from above on the carrier floor and pressed downwards past the stop projections against the springs of the carrier floor.

The carrier floor can *per se* have a flat upper side. However the upper side is preferably of convex form corresponding to the upward curvature effected by the take-off roll mechanism, that is to say it rises from the regions of the second take-off roll and of the abutment towards the middle.

The construction expense of the sheet take-off device can be considerably reduced if an independent drive motor is omitted and the take-off roll mechanism is driven by means of the motor of a processing appliance, for example the willowing machine, which receives the sheets. The device for this purpose is expediently secured as a unit detachably on the processing appliance and the take-off roll mechanism is coupled through a push-in coupling with the drive motor of the processing appliance.

An example of embodiment of the invention is to be explained in greater detail hereinafter by reference to drawings, wherein:-

Figure 1 shows a diagrammatic, partially sectional lateral view of a sheet intake appliance, withdrawing sheets from a sheet stack, in combination with a paper willowing machine, and

Figure 2 shows a detail view of a take-off roll mechanism of the sheet intake appliance, seen along a line II-II in Figure 1.

Figure 1 shows a paper willowing machine 1 having two cutter cylinders 3, 5 rotating oppositely with parallel axes, which shred paper sheets introduced between them on a feed path 7, entered in dot-and-dash lines, and feed them to a waste container (not shown further). The willowing machine 1 as such is not the object of the invention and is not to be explained in greater detail, since it is a matter of a known construction. A sheet intake appliance 9 is detachably fitted on the upper side of the willowing machine 1, which appliance successively draws the uppermost sheet 13 in each case from a sheet stack 11 and feeds it along the feed path 7 to the willowing machine 1. The sheet intake appliance 9 comprises a take-off roll mechanism 15, stationary in relation to the willowing machine 1, in the region of one of the edges of the sheet stack 11. The take-off roll mechanism 15 comprises two take-off rolls 17, 19 arranged with parallel axes one above the other. The upper take-off roll 17 is driven by a motor 20 (Figure 2) in the direction of an arrow 21 in such manner that the sheet 13 entering

between the two take-off rolls 17, 19 is fed along the conveying path 7 to the willowing machine 1. The lower take-off roll 19 is mounted freely rotatably on a control rail 23 which in turn is pivotable on the side of the take-off rolls 17, 19 lying forward in the transport direction of the sheet 13, at a distance from these rolls, about a pivot axis 25 parallel to the axes of rotation of the take-off rolls 17, 19. The take-off roll 19 is initially stressed by a spring indicated at 27 against the presser roll 17, in such a manner that it is drivable in frictional engagement by the upper take-off roll 17 oppositely thereto in the direction of the arrow 29.

The sheet stack 11 lies on a carrier floor 31 which is vertically displaceably guided in a container 33 and is stressed by compression springs 35 together with the sheet stack 11 upwards against the lower take-off roll 19. On the upper edge of the container 33 there are provided inwardly extending stop projections 37, 39 which limit the stroke movement of the sheet stack 11. The stop projections 37 on the side opposite to the take-off roll mechanism 15 further form an abutment which prevents the displacement of the uppermost sheet 13 in its sheet plane by the take-off roll 19 acting in frictional engagement on the uppermost sheet 13. The sheet stretched in between the stop projection 37 and the take-off roll 19 is curved upwards, as illustrated at 13', until it is pushed outwards beneath the take-off roll 19.

The sheet is introduced by the take-off roll 19 between the take-off rolls 17, 19 and a curved stop 41 prevents the sheet from wandering out beyond this position.

The uppermost sheet 13, introduced between the take-off rolls 17, 19 is drawn off from the sheet stack 11, being clamped in between the control rail 23 and the upper take-off roll 17. During the drawing off movement the lower take-off roll 19 is lifted away from the take-off roll 17 and halted by the sheet 13 stretched in between the upper take-off roll 17 and the control rail 23. The take-off roll 19 is thus intermittently driven in order to prevent more than one sheet at a time being introduced between the take-off rolls 17, 19.

Figure 2 shows details of the take-off rolls 17, 19 and of the control rail 23. The take-off roll 17 comprises a plurality of coaxially arranged take-off cylinders 43 connected fast in rotation with one another through a shaft 42 and forming circumferential grooves 45 between them. The control rail 23 comprises a plurality of segments 46 each with several control dogs 47 which engage in the circumferential grooves 45 when the take-off roll 19 is in frictional contact with the take-off cylinders 43. The take-off roll 19 consists of a plurality of take-off cylinders 49 arranged with parallel axes with spacing from one another between the control dogs 47. The take-off cylinders 49 are freely rotatably mounted by groups by means of axle pins 50 on the segments 46. The segments 46 in turn are mounted pivotably in relation to one another on the common spindle 25 in a frame 52 of the take-off roll mechanism 15. As long as there is no sheet betwee the circumferential grooves 45 and the control dogs 47, the take-off cylinders 49 are driven by the take-off cylinders 43. When a sheet is introduced, it lifts the control dogs 47, possibly with serpentine deformation, at least partially out of the circumferential grooves 45 whereby the take-off cylinders 49 are lifted by more than the thickness of the sheet from the take-off cylinders 43. The control dogs 47 extend with spacing from the circumferential grooves 45 so that when the take-off roll mechanism 15 is idling no sliding friction forces occur between the take-off roll 17 and the control rail 23. In the withdrawal of the sheet 13 the control dogs and possibly further zones of the control rail 23 generate the counter-pressure forces of the take-off roll 17.

Provided the distance of the control faces of the control dogs 47 from the pivot axis 25 is less than the axial distance of the spindle 50 from the pivot axis 25, the control rail 23 acts as a step-up lever transmission, so that the take-off roll 19 itself lifts away from the take-off roll 17 by more than the sheet thickness if the control faces do not protrude beyond the circumference of the take-off roll 17 towards the shaft 42. The control faces of the control dogs can also be formed by counter-pressure cylinders or the like rotatably held on the control rail 23.

The wire arch 41 is held on a lid 51 pivotably fitted on a side of the container 33 remote from the take-off rolls. The lid 51 furthermore carries at least one, preferably several, tearing teeth 53 the points of which point towards the carrier floor 31 and penetrate at least the two uppermost sheets of the sheet stack 11 by reason of the pressure of the springs 35. The tearing teeth 53 hold the second-uppermost sheet fast while the take-off roll mechanism 15 draws the uppermost sheet away. In this way the uppermost sheet can be withdrawn from the sheet stack 11 even when its sheets, as indicated at 55, are attached to one another by a metal staple. The uppermost sheet is torn out of the metal staple 45, being slotted by the tearing teeth 53.

In order that the container 33 may be loaded it is horizontally displaceable on a sliding guide 57. After the lid 51 is hinged open the sheet stack 11 can be laid from above on to the carrier floor 31 and pressed past the stop projections 37, 39 into the container 33. In order to reduce the danger of injury on the tearing teeth 53, these are hingeably held on the lid 51, preferably so that they disappear into a socket or the like when the lid 51 is hinged up.

In order to facilitate the curvature of the sheets to be withdrawn, the upper side of the carrier floor 31 is of convex curvature, that is to say it rises from the side of the take-off roll mechanism 15 and from the stop projection 37 forming the abutment for the upward curvature movement towards the middle.

The control rail 23 is divided into a plurality of segments, each of which carries one of the control dogs 47, and which are each independently pivotably mounted on the spindle 25. This measure reduces the production expense and permits a better mutual abutment of the friction cylinders 43 and 49. The friction cylinders 43, 49 can have rubber-elastic outer surfaces to improve the friction.

In order to reduce the construction expense of the take-off device the take-off roll mechanism 15 is driven by the motor 20 of the willowing machine 1. The frame 52 of the take-off roll mechanism 15 extends with an arm 61 (through an opening (not illus-

trated further) in the housing of the willowing machine 1 and carries at its free end a toothed wheel 63 which meshes with a pinion 65 coupled with the motor 20. The toothed wheel 63 is connected through a toothed belt 67 with the shaft 42 and aligned so that on application of the take-off device it engages in the manner of a push-in clutch in the pinion 65.

CLAIMS

1. Device for drawing off sheets from a sheet stack, with a carrier floor (31) for supporting the sheet stack (11), a take-off roll mechanism (15) which comprises at least one take-off roll (17) arranged above the carrier floor (31) and driven by a motor (20) about an axis (42) of rotation parallel to the carrier floor (31) and a feed device (35) for the sheet stack (11) which moves the carrier floor (31) and the take-off roll mechanism (15) resiliently towards one another, characterised in that between the first take-off roll (17), driven by the motor (20) of the take-off roll mechanism (15) and the carrier floor (31) there is arranged a freely rotatable second take-off roll (19) movably guided axially parallel in relation to the first take-off roll (17) and transversely of the rotation axis (42), which second roll in a first position is driven in frictional engagement by the first take-off roll (17) for taking off sheets from the sheet stack (11) and in a second position is lifted away from the first take-off roll (17), in that seen in the sheet-withdrawal direction of the second take-off roll (19) at a distance therefrom an abutment (37) is provided at least for the uppermost sheet (13) in each case of the sheet stack (11), in that to the first take-off roll (17) there is allocated a counter-pressure device (23) for the transport of sheets introduced between the two take-off rolls (17, 19) and in that to the second take-off roll (19) there is allocated a control device (45, 47) responding to sheets introduced between the two take-off rolls (17, 19), which moves the second take-off roll (19) into the first position in the absence of sheets and into the second position when sheets are present.

2.) Device according to Claim 1, characterised in that the second take-off roll (19) is freely rotatably mounted on a control rail (23) which is pivotable axially parallel with the rotation axis (42) of the first take-off roll (17) and initially stressed resiliently towards the first take-off roll (17) and in that the control rail (23) carries control faces (47) co-operating with the first take-off roll (17) for the control movement of the second take-off roll, the distance of which faces from the pivot axis (25) of the control rail (23) is less than the distance of the rotation axis (50) of the second take-off roll (19) from the pivot axis (25).

3.) Device according to Claim 1 or 2, characterised in that the second take-off roll (19) is freely rotatably mounted on a control rail (23) which is pivotable axially parallel with the rotation axis (42) of the first take-off roll (17) and resiliently initially stressed towards the first take-off roll (17), in that the first take-off roll (17) comprises circumferential grooves (45) and in that the control rail (23) comprises control faces, especially control dogs (47), which at least in the first position of the second take-off roll (19) engage in the circumferential groove (45).

4.) Device according to Claim 2 or 3, characterised in that the control rail (23) consists of a plurality of segments (46) arranged one beside the other in the axial direction, movable in relation to one another and carrying the control faces (47) and the second take-off roll (19) consists of a plurality of take-off cylinders (49) mounted axially parallel on the segments (46).

5). Device according to one of Claims 2 to 4, characterised in that the control rail (23) is mounted pivotably on the side of the second take-off roll (19) remote from the abutment (37) on a frame (52) of the take-off roll mechanism (15) and comprises, at least on the side remote from the abutment (37), counter-pressure faces initially stressed resiliently towards the first presser roll (17).

6.) Device according to one of Claims 1 to 6, characterised in that the carrier floor (31) is guided substantially vertically displaceably in a frame (33) and is initially stressed upwards towards the second take-off roll (19) by means of at least one spring (35).

7.) Device according to Claim 6, characterised in that a stop (41) limiting the upward curvature of the sheets is provided on the frame (33) above the carrier floor (31) between the first take-off roll (17) and the abutment (37).

8.) Dvice according to Claim 7, characterised in that the stop (41) and the abutment (37) are arranged in such manner that sheets resting on the abutment (37) and the stop (41) extend with their edge remote from the abutment between the two take-off rolls (17, 19).

9.) Device according to Claim 7 or 8, characterised in that the stop (41) is fitted pivotably on the frame (33).

10.) Device according to one of Claims 6 to 9, characterised in that at least one downwardly protruding tearing tooth (53) which penetrates into the sheet stack in the region of the abutment (37) is arranged on the frame (33).

11.) Device according to one of Claims 6 to 10, characterised in that the frame is formed as a container (33) displaceable in relation to the take-off roll mechanism (15), from which stop projections (37) protrude towards one another above the carrier floor (31) in the region of the take-off roll mechanism (15) and of the side opposite to the take-off roll mechanism (15).

12.) Device according to Claim 11, characterised in that the stop projections (37) remote from the take-off roll mechanism (15) form the abutment.

13.) Device according to one of Claims 1 to 12, characterised in that the upper side of the carrier floor (31) rises towards the middle from the regions of the second take-off roll (19) and of the abutment (37).

14.) Device according to one of Claims 1 to 13, characterised in that the take-off roll mechanism (15) is secured on a processing appliance (1) receiving the sheets, which comprises a drive motor (20), and in that the first take-off roll (19) is coupled with the drive motor through a drive connection (63, 67) which can be disengaged in operation.

15.) Device according to Claim 14, characterised in that it is secured as a unit detachably on the processing appliance and in that the take-off roll mechanism

is coupled with the drive motor (20) through a push-in clutch (63, 65).

16.) A device as claimed in claim 1, substantially as described herein with reference to any one of the examples shown in the accompanying drawings.

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